Yale Institute for Nanoscience and Quantum Engineering

Friday- September 21, 2012

12:00 to 1:00 p.m.

Becton Seminar Room

Light lunch will be served at 11:45 a.m.

Stafford Sheehan

Department of Chemistry, Yale University

"Increasing Solar Cell Efficiency with Plasmonic Nanostructures"

Incorporating metallic nanostructures into dye-sensitized solar cells (DSSCs) is shown to increase light harvesting efficiency by coupling light from the far-field to the near-field, where it can be readily absorbed by molecular chromophores. In order to optimize this system, core-shell-shell nanoparticles along with a nanostructured aggregate architecture have been developed and are shown to significantly improve DSSC efficiency by concentrating light via surface plasmon resonance. Aggregates are shown to absorb light strongly throughout the visible light region and increase overall efficiency from 2.81% to 5.52%, while core-shell-shell nanoparticles are studied to determine the basic processes of plasmonic DSSCs. Comparisons between experimental data and theoretical calculations provide further insight into the structure of the nanoparticles and solar cells made using them. This guides our synthetic approach and aids in our understanding of the nature of plasmonic enhancement in solar cells.

Changchang Liu

Department of Chemical and Environmental Engineering, Yale University

"Synthesis and characterization of ZrO2 nanoparticles supported on multi-walled carbon nanotubes"

We discuss the synthesis of a composite of ZrO_2 nanoparticles supported on multi-walled carbon nanotubes (MWCNT). Using X-ray diffraction and high-resolution transmission electron microscopy (HR-TEM), the ZrO_2 were found to be 2-3 nm tetragonal crystalline nanoparticles. Strong interfacial interaction between the ZrO_2 nanoparticles and the MWCNT surface was observed by near-edge X-ray absorption fine structure spectroscopy (NEXAFS) at the carbon K-edge and the oxygen K-edge, and this strong metal-oxide/support interaction leads to small ZrO_2 particle size and thermal stability, as verified by small-angle X-ray scattering results. The ZrO_2/MWCNT was converted into a solid acid catalyst by sulfation and the properties of S-ZrO_2/MWCNT were studied. Such composites would be good candidates for potential catalysis applications in fuel cell electrodes and biomass processing.

HOST: Mark Reed